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- [54] Invention name: A type of refrigerant

[57] **Abstract:**

A kind of refrigerant, involves in the type of air conditioning, the heat pump and the refrigeration system substitutes R22 or the R502 refrigerant. This refrigerant except includes the difluoromethane and 1,1,1,2 - four fluorine ethane two kind of components, but also includes 1,1,1,2,3,3,3 seven propyl fluoride. This refrigerant does not destroy the ozone layer, has the good hot working performance and the hot working parameter. Compares with the existing substitute, its environment performance is better, its greenhouse effect (GWP value) small, thus may substitute R22 or R502 for a long time, does not have to modify in the existing equipment the major component and the production money, may fill up directly.

**Claims**

1. A kind of refrigerant, include the difluoromethane and 1, 1, 1,2 - four fluorine ethane two kind of compositions, its characteristic also includes 1,1, 1,2,3,3,3 - seven propyl fluoride, its content <weight percentage> respectively is:

Difluoromethane: 10-40%

1,1,1,2 - four fluorine ethane: 40-70%

1, 1, 1, 2, 3, 3, 3 - seven propyl fluoride: 5-30%

2. As claim 1 above mentioned, refrigerant characteristic is in the above refrigerant various components content <weight percentage> respectively is:

Difluoromethane: 20-35%

1,1,1,2 - four fluorine ethane: 0.50%-70%

1,1,1,2,3,3,3 - seven propyl fluoride: 5-20%

### Description

#### One kind of refrigerant

This invention involves the type of refrigerant, involves the type of to use in especially in the air conditioning, the heat pump and the refrigeration system substitutes R22 or the R502 green long term refrigerant.

In the existing technology, took air conditioning, the heat pump, the refrigeration system and in the low temperature refrigeration system refrigerant, mostly uses R22 or R502 since long ago. In 1974 after the research discovered it has the destructive effect to the atmospheric ozone layer, and has the greenhouse effect. Therefore, on international had decided the developing nation <including our country> to R502 from 2005, R22 basically is durable from 2020.

At present, on the international achievement substitutes R22 the refrigerant mainly to have R407C, R410A. R407C is by HFC-32, HFC-125 and the HFC-134a three kind of components is composed; R410A is composed by HFC-32 and HFC-125. In addition also has the type of is composed by HFC-32 and HFC-134a. But R407C COP is lower than about 10% R22; but R410A COP low about 13%, and the unit volume refrigeration quantity increases the about 40% compressors to have to make the redesign, specially the pressure increases very much. If the condensation pressure enhanced about 60% compared to R22, the system and the pipeline also must the redesign. HFC-32/134a COP is lower than about 7% R22, specially has the ignitability under the bad operating mode. Although these three kinds of substitutes do not destroy the ozone layer, but the first two kind of greenhouse effect also is big (R410A GWP is 1900, R407C is 1600).

On international took substitutes R502 the refrigerant mainly to have R404A and R502 for a long time. Former COP is lower than about 15% R502, but latter COP is lower, has lowered about approximately 17%, therefore not really ideal.

This invention purpose and the duty lie in the research development type of environment performance to be better, then for a long time substitutes R22 or R502, moreover the greenhouse effect (GWP value) a lower refrigerant, causes its not to have basically to modify in the existing equipment the major component, and has the finer hot working performance and the hot working parameter.

This invention purpose and the duty are through the below technology plan realization: This refrigerant includes HFC-32 and the HFC-134a two kind of components, its characteristic is also includes FC-1311 and the HFC-152a two kind of components, its various components content <weight percentage> respectively is:

HFC-32	10 – 40%
HFC-134a	40 - 70%
FC-1311	5 - 40%
HFC-152a	0 – 10%

The above refrigerant various components content <weight percentage> may become separately:

HFC-32	10-40%
HFC-134a	40-70%
FC-1311	5-40%
HFC-152a	0- 10%

Or is: HFC32	20-40%
HFC-134a	40- 50%:
FC1311	5-20%
HFC-152a	5-10%

This invention another type of refrigerant, includes HFC-32 and the HFC-134a two kind of components, its characteristic also includes the HFC-227ea component, its various components content <weight percentage> respectively is:

HFC-32	10-40%
HFC-134a	40-70%
HFC-227ea	5-30%

In the above refrigerant four kinds of components content <weight percentage> may become separately:

HFC-32	20-35%
HFC-134a	50-70%
HFC-227ea	5-20%

This invention above mentioned refrigerant, its preparation method is <weight percentage> carries on the above various compositions according to its corresponding formula under the normal temperature the physical mix then.

In above component HFC-32, namely is called the difluoromethane, its molecular formula is  $\text{CH}_2\text{F}_2$ , the molecular weight is 52.02, the normal boiling point for  $-51.7^\circ\text{C}$ , the critical temperature for  $78.2^\circ\text{C}$ , the critical pressure is 5.8Mpa.

HFC-134a also called 1,1,1,2-tetrafluoroethane, its molecular formula is  $\text{CH}_2\text{FCF}_3$ , the molecular weight is 102.03, the normal boiling point is  $-26.1^\circ\text{C}$ , the critical temperature for  $101.1^\circ\text{C}$ , the critical pressure is 4.06Mpa.

FC-1311 also called three fluorine methyl iodide, its molecular formula is  $\text{CF}_3\text{I}$ , the molecular weight is 195.91, the normal boiling point for  $-22.5^\circ\text{C}$ , the critical temperature for  $121.9^\circ\text{C}$ , the critical pressure is 4.04Mpa.

HFC-152a, also calls 1,1-ethyldiene perchloride, its molecular formula is  $\text{CH}_3\text{CHF}_2$ , the molecular weight is 66.05, the normal boiling point for  $-24^\circ\text{C}$ , the critical temperature for  $96.8^\circ\text{C}$ , the critical pressure is 4.25Mpa.

HFC-227ea, also calls 1,1,1,2,3,3,3-heptafluoroethane, its molecular formula is  $\text{CH}_3\text{CHF}_2\text{CF}_3$ , the molecular weight is 170.03, the normal boiling point for  $-18.3^\circ\text{C}$ , the critical temperature for  $103.5^\circ\text{C}$ , the critical pressure is 2.95Mpa.

Must limits the qualitative implementation example with below to give the further explanation to this invention refrigerant, will be helpful to this invention and its the advantage understanding, but did not take to this invention definition, this invention extent of protection defined by the claims.

Implementation example 1:

Takes 30% HFC-32, 35% HFC-134a and 35% FC-1311, carries on these three kind of components after the normal temperature the physical mix to take the refrigerant.

Implementation example 2:

Takes 4% HFC-32, 45% HFC-134a, after 5% FC-1311 and 10% HFC-152a these four kind of components carry on the physical mix to take the refrigerant.

Implementation example 3:

Takes 26% HFC-32, 69% HFC-134a and 5% HFC-227ea three kinds of components carries on the physical mix after the normal temperature to take the refrigerant.

If air conditioning, the heat pump system design operating mode takes is: The vaporization temperature for  $7.2^\circ\text{C}$ , the condensing temperature for  $54.4^\circ\text{C}$ , crosses cold degree is  $8.3^\circ\text{C}$ , the inspiration temperature  $11.1^\circ\text{C}$ , the press efficiency is 80%, according to circulates the

computation, the above implementation example 1, 2 and 3 related parameters as well as and has three kind of substitutes comparisons with R22 to be listed in table 1.

Table 1 Implementation example refrigerant performance and R22 and have three kind of main substitutes comparisons

	R22	R407C	R410A	HFC-32/134a	实施例 1	实施例 2	实施例 3
ODP	0.05	0	0	0	0	0	0
GWP	1700	1600	1900	1100	629	831	1212
蒸发压力 MPa	0.62	0.68	1.04	0.63	0.66	0.70	0.60
冷凝压力 MPa	2.17	2.50	3.48	2.36	2.43	2.55	2.26
压比	3.48	3.70	3.35	3.75	3.65	3.70	3.76
排气温度 °C	97.2	86.7	95.1	91.2	95.1	96.5	88.4
COP*	1.0	0.91	0.87	0.94	0.95	0.94	0.94
冷量*	1.0	0.91	0.94	1.06	0.92	1.15	1.01
容积制冷量*	1.0	0.99	1.38	0.98	1.04	1.08	1.00

  

	R22	R407C	R410A	HFC-32/134a	Implementation example 1	Implementation example 2	Implementation example 3
ODP							
GWP							
Evaporates pressure MPa							
Condensation pressure MPa							
Presses the ratio							
Discharge temperature °C							
COP*							
Cold volume*							
Volume refrigeration quantity							

\* Is and the R22 relative value.

By on table obviously, these three implementations example environment performance ODP and GWP are better than R22, moreover GWP also has two kinds of substitutes R407C and R410A is better than, is better than HFC-32/134a or quite. Looking from the discharge temperature, these three kinds of implementations example also with R22 quite or slightly low. The condensation pressure, evaporates parameters and so on pressure to be close with R22, moreover is in the permission scope, may fill up directly. Looking from the hot working performance, although COP is slightly lower than R22, but has two kind of substitutes R407C and R410A is better than, but and HFC32/134a quite. Cold average volume compared to R22 and existing substitute big or equal, also namely meant fills up the quantity to be possible to be less than them or quite. Volume refrigeration quantity approximately with R22 basic quite, some also high 0% several. These three

implementations example with has three kind of substitutes R407C, R410A and HFC-32/134a is same, all needs to replace the lubricating oil.

Implementation example 4

Takes 35% HFC-32, 50% HFC-134a and 15% FC-1311 these three kind of components carry on the physical mix after the normal temperature to take the refrigerant.

Implementation example 5:

Takes 40% HFC-32, 45% HFC-134a, 5% FC-1311 and 10 % HFC-152a these four kinds of components carry on the physical mix after the normal temperature to take the refrigerant.

Implementation example 6:

Takes 32% HFC-32, 58% HFC-134a and 10% HFC-227ea three kinds of components carry on the physical mix after the normal temperature to take the refrigerant.

If the low temperature refrigeration operating mode is: Vaporization temperature  $-30^{\circ}\text{C}$ , condensing temperature  $40^{\circ}\text{C}$ , excessively cold  $0^{\circ}\text{C}$ ; The inspiration temperature  $18^{\circ}\text{C}$ , the press efficiency 70%, according to circulates the computation, the above implementation example 4, 5 and 6 related parameters as well as and has two kind of substitutes comparisons with R502 to be listed in table 2.

Table 2 implementations examples refrigerant performance and R502 and have two kind of main substitutes comparisons

	R502	R404A	R507	实施例 4	实施例 5	实施例 6
ODP	0.214	0	0	0	0	0
GWP	4510	3850	3900	853	831	1270
蒸发压力 MPa	0.18	0.23	0.24	0.17	0.17	0.16
冷凝压力 MPa	1.61	1.98	2.03	1.78	1.80	1.70
COP*	1.0	0.84	0.82	1.04	1.05	1.02
冷量	1.0	0.92	0.88	1.64	1.86	1.63
容积制冷量*	1.0	1.02	1.03	1.09	1.12	1.00

	R22	R407 C	R410 A	HFC-32/134a	Implementation example 4	Implementation example 5	Implementation example 6
ODP							
GWP							
Evaporates pressure MPa							
Condensation pressure MPa							
Presses the ratio							
Discharge temperature °C							
COP *							
Cold volume *							
Volume refrigeration quantity							

\* Is and the R502 relative ratio.

By on table obviously, these three implementations example GWP value and has two kind of main substitutes R502 to be lower than, the showing environment performance is better; pressure parameter and R502 quite, moreover has two kind of main substitutes to be lower than. Looking from the hot working performance, regardless of COP, cold volume and the volume refrigeration quantity also and has two kind of main substitutes R502 to be better than. These three implementations example with has two kind of main substitutes to be same, needs to replace the lubricating oil.

This invention and the existing technology compare, have following advantage and the beneficial effect: Its environment better, does not destroy the ozone layer, may substitute R22 or R502 for a long time, also greenhouse effect (GWP value) small. In does not have to modify in the existing equipment the major component and under the production line premise, regardless of COP, cold volume and the volume refrigeration quantity is also friends with compared to the existing substitute, thus this invention has the finer hot working performance and the hot working parameter, and may carry on directly fills up.